Synthesis Technique to Achieve High-Anisotropy FeNi

Tech ID: 27099 / UC Case 2016-822-0

ABSTRACT

Researchers at the University of California, Davis have developed an innovative synthesis approach to achieve high anisotropy L1 FeNi by combining physical vapor deposition and a high speed rapid thermal annealing (RTA).

FULL DESCRIPTION

Magnetic anisotropy is a material property that anchors magnetic moments in place, enabling their practical use. High magnetic anisotropy materials are essential to the advancement of high energy density permanent magnets and ultrahigh density heat-assisted magnetic recording media. Current leading alloy candidates for recording media applications and permanent magnets include FePt, CoPt, FePd, NdFeB, and SmCo, which contain either precious noble metals or rare-earth elements. These materials are expensive and prone to extreme price fluctuations. An attractive alternative material is L10 FeNi, which is a metastable high anisotropy phase in a face-centered tetragonal crystal structure. It is conventionally formed by neutron bombardment, but the process is slow and impractical.

Researchers at the University of California, Davis have developed an innovative synthesis approach to achieve high anisotropy FeNi by combining physical vapor deposition via atomic layer sputtering and high speed RTA. This FeNi synthesis contains only common earth-abundant elements, thus substantially reducing real costs and the economic uncertainties therein. This synthesis approach leads to stable L10 FeNi films with an anisotropy of >106 erg/cm3, substantially higher than the cubic A1 phase, and a high Curie temperature.

APPLICATIONS

- High energy density permanent magnets
- Magnetic recording
- Hybrid/electric vehicles
- Motors
- Generators
- MRI systems
- Magnetically levitated trains
- Wind turbines
- Power storage
- Consumer electronics (Cell phones, DVD/CD players, speakers)
- Magnetic refrigeration
- Materials separation

FEATURES/BENEFITS

- High magnetic anisotropy
- High Curie temperature
- Earth-abundant common elements
- Cost effective
- Less prone to price fluctuations
- Convenient manufacturing

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,685,781	06/16/2020	2016-822

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OTHER INFORMATION

KEYWORDS

L10 FeNi, high magnetic anisotropy, rapid thermal annealing

CATEGORIZED AS

- **Computer**
  - Hardware
  - Security
- **Energy**
  - Other
  - Storage/Battery
  - Wind
- **Engineering**
  - Engineering
- **Imaging**
  - Medical
- **Materials & Chemicals**
  - Electronics Packaging
  - Nanomaterials
  - Thin Films
- **Medical**
  - Diagnostics
  - Imaging
- **Nanotechnology**
  - Electronics

- Materials
- Tools and Devices
- **Sensors & Instrumentation**
- Scientific/Research
- **Transportation**
- Aerospace
- Automotive
- Other

RELATED CASES

2016-822-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Realization Of Artificial Magnetic Skyrmions At Room Temperature
- 3D Magnetic Topological Structures for Information Storage

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